PRVD2008-10

Proposed Re-evaluation Decision

Imazapyr

(publié aussi en français)

22 February 2008

This document is published by the Health Canada Pest Management Regulatory Agency. For further information, please contact:

Publications
Pest Management Regulatory Agency
Health Canada
2720 Riverside Drive
A.L. 6605C
Ottawa, Ontario
K1A 0K9

Internet: pmra_publications@hc-sc.gc.ca
www.pmra-arla.gc.ca
Facsimile: 613-736-3758
Information Service:
1-800-267-6315 or 613-736-3799
pmra_infoserv@hc-sc.gc.ca

Canada

ISBN: 978-0-662-48040-2 (978-0-662-48041-9)
Catalogue number: H113-27/2008-10E (H113-27/2008-10E-PDF)

© **Her Majesty the Queen in Right of Canada, represented by the Minister of Health Canada, 2008**

All rights reserved. No part of this information (publication or product) may be reproduced or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, or stored in a retrieval system, without prior written permission of the Minister of Public Works and Government Services Canada, Ottawa, Ontario K1A 0S5.

Table of Contents

Overview 1
What Is the Proposed Re-evaluation Decision? 1
What Does Health Canada Consider When Making a Re-evaluation Decision? 1
What Is Imazapyr? 2
Health Considerations 3
Environmental Considerations 3
Measures to Minimize Risk 4
Next Steps 4

Science Evaluation 5

1.0 Introduction 5

2.0 The Technical Grade Imazapyr, Its Properties and Uses 5
2.1 Identity of the Technical Grade Active Ingredient 5
2.2 Physical and Chemical Properties of the Technical Grade Imazapyr 6
2.3 Comparison of Use Patterns in Canada and the United States 6

3.0 Impact on Human Health and the Environment 7
3.1 Human Health 7
3.1.1 Occupational Exposure and Risk Assessment 7
3.1.2 Non-Occupational Exposure and Risk Assessment 9
3.1.3 Cumulative Effects 10
3.2 Environment 10
3.2.1 Environmental Risk Assessment 10
3.2.2 Toxic Substances Management Policy Considerations 12

4.0 OECD Status of Imazapyr 12

5.0 Proposed Re-evaluation Decision 14

6.0 Supporting Documentation 14

List of Abbreviations 15

Appendix I Registered Products Containing Imazapyr as of October 2007 17

Appendix II Toxicological Endpoints for Imazapyr Health Risk Assessments[a] 19

Appendix III Label Amendments for Products Containing Imazapyr 21

Appendix IV Inputs to Buffer Zone Models 23

References 25

Overview

What Is the Proposed Re-evaluation Decision?

After a re-evaluation of the herbicide imazapyr, Health Canada's Pest Management Regulatory Agency (PMRA), under the authority of the *Pest Control Products Act* and Regulations, is proposing continued registration for the sale and use of products containing imazapyr in Canada.

An evaluation of available scientific information found that products containing imazapyr do not present unacceptable risks to human health or the environment when used according to label directions. As a condition of the continued registration of imazapyr uses, new risk-reduction measures must be included on the labels of all products. No additional data are being requested at this time.

This proposal affects all end-use products containing imazapyr registered in Canada. Once the final re-evaluation decision is made, the registrants will be instructed on how to address any new requirements.

This Proposed Re-evaluation Decision is a consultation document[1] that summarizes the science evaluation for imazapyr and presents the reasons for the proposed re-evaluation decision. It also proposes additional risk-reduction measures to further protect human health and the environment.

The information is presented in two parts. The Overview describes the regulatory process and key points of the evaluation, while the Science Evaluation provides detailed technical information on the assessment of imazapyr.

The PMRA will accept written comments on this proposal up to 45 days from the date of publication of this document. Please forward all comments to Publications (please see contact information on the cover page of this document).

What Does Health Canada Consider When Making a Re-evaluation Decision?

The PMRA's pesticide re-evaluation program considers potential risks, as well as value, of pesticide products to ensure they meet modern standards established to protect human health and the environment. Regulatory Directive DIR2001-03, *PMRA Re-evaluation Program*, presents the details of the re-evaluation activities and program structure.

---

[1] "Consultation statement" as required by subsection 28(2) of the *Pest Control Products Act*.

Imazapyr, one of the active ingredients in the current re-evaluation cycle, has been re-evaluated under Re-evaluation Program 1. This program relies as much as possible on foreign reviews, typically United States Environmental Protection Agency (USEPA) Re-registration Eligibility Decision (RED) documents. For products to be re-evaluated under Program 1, the foreign review must meet the following conditions:

- it covers the main science areas, such as human health and the environment, that are necessary for Canadian re-evaluation decisions;
- it addresses the active ingredient and the main formulation types registered in Canada; and
- it is relevant to registered Canadian uses.

Given the outcome of foreign reviews and a review of the chemistry of Canadian products, the PMRA is proposing a re-evaluation decision and is requiring appropriate risk-reduction measures for Canadian uses of an active ingredient. In this decision, the PMRA takes into account the Canadian use pattern and issues (e.g. the federal Toxic Substances Management Policy (TSMP)).

Based on the health and environmental risk assessments published in the 2006 RED, the USEPA concluded that imazapyr was eligible for re-registration provided risk-reduction measures were adopted. The PMRA compared the American and Canadian use patterns and found the USEPA assessments described in this RED were an adequate basis for the proposed Canadian re-evaluation decision.

For more details on the information presented in this overview, please refer to the Science Evaluation section of this consultation document.

What Is Imazapyr?

Imazapyr is a herbicide registered for use in Canada to control annual and perennial grasses, broadleaf weeds and select perennial shrubs and trees on the following non-crop, non-graze areas: forest sites being prepared by ground application, industrial sites, railroad ballast, spot application treatment for rail and hydro rights-of-way and stations associated with pipeline rights-of-way, including well sites, battery stations, and compressor or valve stations. It is applied using ground spray and hand-held equipment typically by licensed applicators only.

Health Considerations

Can Approved Uses of Imazapyr Affect Human Health?

Imazapyr is unlikely to affect your health when used according to revised label directions.

People could be exposed to imazapyr by consuming water, working as a mixer/loader/applicator or by entering treated sites. The PMRA considers two key factors when assessing health risks: the levels at which no health effects occur and the levels to which people may be exposed. The dose levels used to assess risks are established to protect the most sensitive human population (e.g. children and nursing mothers). Only uses for which exposure is well below levels that cause no effects in animal testing are considered acceptable for continued registration.

The USEPA concluded that imazapyr was unlikely to affect human health provided that risk-reduction measures were implemented. These conclusions apply to the Canadian situation, and equivalent risk-reduction measures are required.

Maximum Residue Limits

In Canada, imazapyr is registered for use on non-crop, non-graze areas only (no food use registered). No Canadian maximum residue limits (MRLs) have been established for imazapyr.

Environmental Considerations

What Happens When Imazapyr Is Introduced Into the Environment?

Imazapyr is unlikely to affect non-target organisms when used according to revised label directions.

Non-target organisms (e.g. birds, mammals, insects, aquatic organisms and terrestrial plants) could be exposed to imazapyr in the environment. Environmental risk is assessed by the risk quotient method – the ratio of the estimated environmental concentration to the relevant effects endpoint of concern. The resulting risk quotients are compared to corresponding levels of concern. A risk quotient less than the level of concern is considered a negligible risk to non-target organisms, whereas a risk quotient greater than the level of concern indicates some degree of risk.

The USEPA concluded that the re-registration of imazapyr was acceptable provided risk-reduction measures to further protect the environment were implemented. These conclusions apply to the Canadian situation, and equivalent risk-reduction measures are currently in place in Canada. Furthermore, the PMRA will require both aquatic and terrestrial buffer zones for imazapyr to protect both aquatic organisms and terrestrial plants from spray drift.

Measures to Minimize Risk

Labels of registered pesticide products include specific instructions for use. Directions include risk-reduction measures to protect human and environmental health. These directions must be followed by law. As a result of the re-evaluation of imazapyr, the PMRA is proposing further risk-reduction measures for product labels.

Human Health

- A statement preventing workers and others from entering treated areas until sprays have dried.

Environment

- Buffer zones to protect non-target sensitive aquatic and terrestrial habitats.

Next Steps

Before making a final re-evaluation decision on imazapyr, the PMRA will consider all comments received from the public in response to this consultation document. The PMRA will then publish a Re-evaluation Decision[2] document that will include the decision, the reasons for it, a summary of comments received on the proposed decision and the PMRA's response to these comments.

---

[2] "Decision statement" as required by subsection 28(5) of the *Pest Control Products Act*.

Science Evaluation

1.0 Introduction

Imazapyr is a herbicide, which is registered for use in Canada (Use-site Category 16) to control annual and perennial grasses, broadleaf weeds and select perennial shrubs and trees on non-crop, non-graze areas. Imazapyr acts by preventing the synthesis of branched-chain amino acids. This leads to interference in DNA synthesis and cell growth of the plants.

Following the re-evaluation announcement for imazapyr, the registrant of the technical grade imazapyr in Canada indicated that it intended to provide continued support for all uses included on the labels of commercial end-use products in Canada.

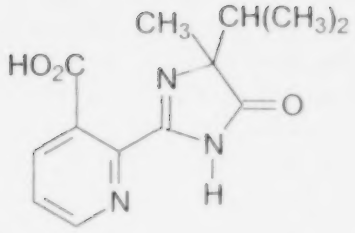
The PMRA used recent assessments of imazapyr from the United States Environmental Protection Agency (USEPA). The USEPA Re-registration Eligibility Decision (RED) document for imazapyr, dated 2006, can be found on the USEPA Pesticide Registration Status page at www.epa.gov/pesticides/reregistration/status.htm.

2.0 The Technical Grade Imazapyr, Its Properties and Uses

2.1 Identity of the Technical Grade Active Ingredient

Active substance:	Imazapyr
Function:	Herbicide
Chemical names:	
IUPAC:	2-(4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)nicotinic acid
CAS:	2-[4,5-dihydro-4-methyl-4-(methylethyl) -5-oxo-1-H imidazol-2-yl]-3-pyridinecarboxylic acid
Chemical class:	Imidazolinone
CAS Registry Number:	81334-34-1
Molecular formula:	$C_{13}H_{15}N_3O_3$
Molecular weight:	261.3 amu

Structural formula:



Based on the manufacturing process, the product is not expected to contain impurities of human health or environmental concern as identified in Regulatory Directive DIR98-04, *Chemistry Requirements for the Registration of a Technical Grade of Imazapyr or an Integrated System Product*, Section 2.13.4 or Toxic Substances Management Policy (TSMP) Track 1 substances as identified in Regulatory Directive DIR99-03, *The Pest Management Regulatory Agency's Strategy for Implementing the Toxic Substances Management Policy*, Appendix II.

2.2 Physical and Chemical Properties of the Technical Grade Imazapyr

Property	Result
Vapour pressure	<0.013 mPa
UV–visible spectrum	Not expected to absorb at $\lambda > 300$ nm
Solubility in water	9.74 g/L at 15°C 11.3 g/L at 25°C
n-Octanol–water partition coefficient	Log $K_{ow} = 0.11$
Dissociation constant	$pKa_1 = 1.9$ $pKa_2 = 3.6$

2.3 Comparison of Use Patterns in Canada and the United States

Imazapyr is a herbicide registered for use in Canada (Use-site Category 16) to control annual and perennial grasses, broadleaf weeds and select perennial shrubs and trees on the following non-crop, non-graze areas: forest sites being prepared by ground application, industrial sites, railroad ballast, spot application treatment for rail and hydro rights-of-way and stations associated with pipeline rights-of-way, including well sites, battery stations and compressor or valve stations. In Canada, imazapyr is applied using ground spray and hand-held equipment typically by licensed applicators only. Imazapyr is only applied once per year.

The American and Canadian use patterns were compared. The Canadian formulations, use sites, maximum application rates and application methods are encompassed by those of the U.S. Based on this comparison, it was concluded that the USEPA RED for imazapyr is an adequate basis for the re-evaluation of Canadian uses of imazapyr.

There is one technical and one commercial end-use product (formulated as a solution) containing imazapyr, present as the isopropylamine salt, registered in Canada. All current uses are being supported by the registrant and were therefore considered in the re-evaluation of imazapyr. Appendix I lists all imazapyr products that are registered as of October 2007 under the *Pest Control Products Act*.

3.0 Impact on Human Health and the Environment

In its 2006 RED, the USEPA concluded that the end-use products formulated with imazapyr met the safety standard under the American *Food Quality Protection Act* (FQPA)and would not pose unreasonable risks or adverse effects to humans and the environment if used according to the amended product labels.

3.1 Human Health

Toxicology studies in laboratory animals describe potential health effects resulting from various levels of exposure to a chemical and identify dose levels at which no effects are observed. Unless there is evidence to the contrary, it is assumed that effects observed in animals are relevant to humans and that humans are more sensitive to effects of a chemical than the most sensitive animal species.

Exposure to imazapyr may occur through consumption of food and water. When assessing health risks, the PMRA considers two key factors: the levels at which no health effects occur and the levels to which people may be exposed. The dose levels used to assess risks are established to protect the most sensitive human population (e.g. children and nursing mothers).

3.1.1 Occupational Exposure and Risk Assessment

Occupational risk is estimated by comparing potential exposures with the most relevant endpoint from toxicology studies being used to calculate a margin of exposure (MOE). This is compared to a target MOE incorporating safety factors protective of the most sensitive subpopulation. If the calculated MOE is less than the target MOE, it does not necessarily mean that exposure will result in adverse effects, but mitigation measures to reduce risk would be required.

The USEPA's toxicological endpoints for assessing risk from occupational exposure are summarized in Appendix II.

Workers can be exposed to imazapyr when mixing, loading or applying the pesticide and when entering a treated site to conduct activities.

3.1.1.1 Mixer/Loader/Applicator Exposure and Risk

Short- and intermediate-term exposure scenarios for mixers, loaders and applicators were identified by the USEPA. Exposure was assumed to occur via the dermal and inhalation routes. The exposure scenarios assessed by the USEPA that are relevant to the Canadian use of imazapyr are as follows:

1) mixing/loading liquids to support rights-of-way equipment
2) mixing/loading liquids for groundboom applications
3) mixing/loading/applying liquids with a low-pressure handwand
4) mixing/loading/applying liquids with a handgun sprayer
5) mixing/loading/applying liquids with a backpack sprayer
6) applying liquid sprays via rights-of-way equipment
7) applying liquid sprays via groundboom equipment

Handler exposure was estimated using the Pesticide Handlers Exposure Database (PHED) and Occupational and Residential Exposure Task Force (ORETF) database and was based on an application rate of 1.69 kg a.e./ha (maximum U.S. rate). Dermal and inhalation absorption were assumed to be equivalent to oral absorption.

An oral no observed adverse effect level (NOAEL) of 250 mg/kg/day based on a one-year dog feeding study was used to estimate short- and intermediate-term combined dermal and inhalation MOEs for occupational exposure scenarios. MOEs ranged from 110 to 9900 for handlers wearing baseline personal protection equipment (including long-sleeved shirt, long pants) and chemical-resistant gloves. MOEs were found acceptable provided workers wear a long-sleeved shirt, long pants and chemical-resistant gloves.

The USEPA reported that long-term handler exposures were not expected for imazapyr, because it is only applied once per year.

The RED adequately addressed potential exposure scenarios associated with the Canadian uses of imazapyr. Thus conclusions derived in the RED are considered applicable to the Canadian situation. It is indicated on the current Canadian label that a long-sleeved shirt, long pants and chemical-resistant gloves must be worn when handling the product. No further mitigation measures are required.

3.1.1.2 Postapplication Exposure and Risk

The USEPA conducted an occupational postapplication risk assessment based on the agricultural use, using an application rate of 0.16 kg a.e./ha, considered to be a worst-case scenario. Acceptable short- and intermediate-term dermal MOEs were reported at day 0, ranging from 4100 to 700 000 for the scenarios of hand weeding, scouting, irrigating and hand harvesting. To further protect workers from potential postapplication exposure, a 48-hour restricted-entry interval (REI) was required by the USEPA for agricultural crops.

Occupational postapplication activities on non-crop areas, such as industrial sites, were not expected to be as intense as on agricultural crops, and a quantitative risk assessment was not conducted. To mitigate potential postapplication exposure in non-crop areas, the USEPA required re-entry into treated areas to be prohibited until sprays have dried.

Inhalation exposures to imazapyr were thought to be negligible in outdoor postapplication scenarios based on low volatility and were not considered by the USEPA in the assessment.

The USEPA risk assessment encompassed the Canadian application of imazapyr (which is used on non-crop areas only). Conclusions derived in the RED are considered applicable to the Canadian situation. The PMRA requires that entry into treated areas be prohibited until sprays have dried to further protect workers from postapplication exposure.

The proposed label amendments are listed in Appendix III.

3.1.2 Non-Occupational Exposure and Risk Assessment

3.1.2.1 Residential Exposure

Residential risk was assessed by the USEPA but will not be discussed here because there is no residential use of imazapyr in Canada. The Canadian label states that imazapyr is not to be used on lawns, walks, driveways, tennis courts or similar areas.

3.1.2.2 Exposure From Food and Drinking Water

The USEPA assessed dietary risk because imazapyr is also registered for use on field corn in the U.S. An acute dietary exposure assessment was not conducted because no toxic effects resulting from acute exposure were seen in the imazapyr toxicity database. Imazapyr was classified as a Group E chemical, "not likely to be carcinogenic", and a cancer risk assessment was not required.

Chronic dietary risk is estimated by determining how much of a pesticide residue may be ingested with the daily diet and comparing this potential exposure to an acceptable daily intake, which is the dose at which an individual could be exposed over the course of a lifetime and expect no adverse health effects. The acceptable daily intake is referred to as the ADI in Canada, and in the RED, it is expressed as the chronic population adjusted dose (cPAD). The ADI is based on a relevant endpoint from toxicology studies and on safety factors protective of the most sensitive subpopulation (see Appendix II).

Chronic dietary risk assessment from food plus drinking water was conducted by the EPA using the Dietary Exposure Evaluation Model (DEEM). The assessment was based on a reference dose of 0.25 mg/kg a.i./day, assuming residues were at tolerance levels, 100% of crops were treated, and a modelled estimated drinking water concentration (EDWC) of imazapyr in surface water of 79 µg/L. The EDWC was established by modelling imazapyr non-crop uses at the maximum application of 1.69 kg a.e./ha using the FQPA Index Reservoir Screening Tool (FIRST), a Tier I model. The combined chronic exposure from food and drinking water was less than 0.1% of the cPAD, for the general U.S. population and all population subgroups (including infants <1 year old).

There is no food use of imazapyr in Canada. The Canadian use pattern and application rate are encompassed by those of the U.S. The USEPA drinking water assessment was also based on a higher application rate than that used in Canada. The USEPA assessment is considered to address the Canadian situation. The exposure from food and drinking water was not of concern. Based on this, no additional mitigation measures are required.

3.1.2.3 Aggregate Risk Assessment

Aggregate risk combines the different routes of exposure to imazapyr (i.e. from food, water and residential exposure). Potential exposures from food, drinking water and residential scenarios were considered in the RED and aggregated for imazapyr. The USEPA concluded that aggregate risks do not exceed the level of concern. Therefore, no risk mitigation measures are required to address these exposure scenarios.

In Canada, there are no food uses or residential uses of imazapyr. Potential dietary and drinking water exposure to imazapyr in Canada was adequately addressed by the RED, as discussed in Section 3.1.2.2.

3.1.3 Cumulative Effects

The USEPA has not determined whether imazapyr has a common mechanism of toxicity with other substances or whether it shares a toxic metabolite produced by other substances. Therefore, it was assumed that imazapyr does not share a common mechanism of toxicity with other substances, and a cumulative risk assessment was not required.

3.2 Environment

3.2.1 Environmental Risk Assessment

Imazapyr was reported to be mobile via runoff to surface water but to degrade rapidly by photolysis.

Imazapyr was reported to have the potential to leach to groundwater and was expected to persist due to its stability to hydrolysis and aquatic microbial degradation. Imazapyr was found to be persistent in soil. The log K_{ow} of imazapyr (1.3), reported by the RED, indicated that it was unlikely to bioaccumulate.

Although imazapyr was expected to be mobile in the environment, modelling results from the USEPA generally predicted low concentrations in ground and surface water.

To assess the ecological risk of imazapyr to both terrestrial and aquatic non-target plants and animals, the USEPA calculated risk quotients (RQs) based on appropriate toxicity endpoints and expected environmental concentrations (EECs) and compared the resulting RQs to corresponding levels of concern (LOCs). The assessment was based on non-crop use scenarios, including ground spray application. The application rates used in the assessment ranged from 1.01 to 1.69 kg a.i./ha.

The USEPA concluded that imazapyr is practically non-toxic to birds, mammals, insects, freshwater and marine/estuarine fish and invertebrates. The chronic RQs did not exceed the LOC of one for any of the scenarios. As a result, the potential risk for imazapyr to have adverse effects on terrestrial and aquatic animals was expected to be low.

The acute risk was not acceptable for terrestrial plants located adjacent to treated areas or semi-aquatic areas as a result of runoff and spray drift from ground spray application. Imazapyr acid was found to be highly toxic to aquatic vascular plants. The acute risk RQs exceeded the LOC for vascular plants. The acute risk was acceptable for aquatic non-vascular plants.

Based on concerns for both terrestrial and aquatic non-target plants, the USEPA required the following mitigation measures to reduce ecological exposure:

- For groundboom applications, applicators were required to use a nozzle height below four feet above the ground or plant canopy and coarse or coarser droplet size (ASAE S572) or, if specifically using a spinning atomizer nozzle, applicators were required to use a volume mean diameter (VMD) of 385 microns or greater;
- For groundboom applications, applications with wind speeds greater than 16 km/h were prohibited;
- Applications during temperature inversions were prohibited.

Conclusions and resulting mitigation measures in the USEPA RED are considered relevant to the Canadian situation. Based on this, terrestrial and aquatic buffer zones were calculated by the PMRA to protect both aquatic and terrestrial plants from spray drift. Proposed label amendments are listed in Appendix III. Inputs to buffer zone models are described in Appendix IV.

3.2.2 Toxic Substances Management Policy Considerations

The management of toxic substances is guided by the 1995 federal Toxic Substances Management Policy (TSMP), which puts forward a preventive and precautionary approach to deal with substances that enter the environment and could harm the environment or human health. The policy provides decision makers with direction and sets out a science-based management framework to ensure that federal programs are consistent with its objectives. One of the key management objectives is virtual elimination from the environment of toxic substances that result predominantly from human activity and that are persistent and bioaccumulative. These substances are referred to in the policy as Track 1 substances.

The federal Toxic Substances Management Policy and PMRA Regulatory Directive DIR99-03, *The Pest Management Regulatory Agency's Strategy for Implementing the Toxic Substances Management Policy*, were taken into account during the re-evaluation of imazapyr. The PMRA has reached the following conclusions:

- Imazapyr is not bioaccumulative. The *n*-octanol–water partition coefficient (log K_{ow}) was reported to be 1.3 by the USEPA, which is below the TSMP Track 1 cut-off criterion of ≥5.0. Imazapyr was found to be persistent. Aerobic soil half-life is $t_{1/2}$ > 296 days, which meets the TSMP Track 1 persistence criterion (>182 days in soil). Imazapyr does not meet all Track 1 criteria; thus, it is not a candidate for Track 1 classification.

- Based on a review of the available chemistry information, the technical grade product is not expected to contain impurities of toxicological concern as identified in DIR98-04, or TSMP Track 1 substances as identified in DIR99-03, Appendix II.

- No data were available on transformation products.

Formulant issues are being addressed through PMRA formulant initiatives and Regulatory Directive DIR2006-02, *Formulants Policy and Implementation Guidance Document*, published on 31 May 2006.

4.0 OECD Status of Imazapyr

Canada is part of the Organisation for Economic Co-operation and Development (OECD), which includes 30 member countries and provides governments with a setting in which to discuss, develop and perfect economic and social policies. They compare experiences, share information and analyses, seek answers to common problems, and work to co-ordinate domestic and international policies to allow for consistency in practices across nations.

Based on the current available information on the status of imazapyr in other OECD member countries, imazapyr has been prohibited for import, sale and use in Norway since December 2001. This is due to potential groundwater contamination, based on its mobility and persistence in soil.[3] Imazapyr has not been permitted for use in Europe since 2002.[4] Pesticides cannot be used in the European Union unless they are included on a community "positive list." An evaluation program to create this list was launched in 1993, when the European Commission (EC) started a review process for all active substances used in plant protection products in the EU. When imazapyr was called for review within this program, the registrant companies chose not to defend this substance, and it was therefore no longer permitted for pesticide use in Europe. Some essential uses have been granted for a limited time. Nevertheless, essential uses were granted approval for an extended use period for sales up to 30 June 2007, with a sellout period until 31 December 2007.

As described earlier in this document, the United States, also an OECD member, assessed the registration of all uses of imazapyr in 2006 and concluded that using imazapyr as a pesticide does not result in unreasonable adverse effects to human health or the environment provided the risk-reduction measures recommended in the RED document were implemented. Although imazapyr was reported by the USEPA to have the potential to leach to groundwater and to be persistent, modelling results generally predicted low concentrations in ground and surface water. The highest predicted water concentration (from surface water), estimated with a Tier I computer model and based on the maximum application rate, was included in the aggregate risk assessment and found to be acceptable. The USEPA concluded that exposure from groundwater was likely to be minimal and was not of concern.

The Canadian re-evaluation of imazapyr is largely based on the 2006 USEPA assessments. As described in Section 3.0 above, the PMRA has found the USEPA environmental and human health risk conclusions to be relevant to the use of imazapyr in Canada and requires measures to mitigate potential risk to human health and the environment. The concerns identified in Norway relating to the environmental properties of the active ingredient were taken into consideration in the re-evaluation of imazapyr in Canada and have been addressed in the proposed Canadian re-evaluation decision.

---

[3] This information was found in PIC circular IV, December 2001. PIC circulars are published by the Rotterdam Convention Secretariat. Under this Convention, parties to the Convention have committed to inform other parties about legislative bans or severe restrictions on the use of chemicals and to notify recipient countries of any exports of regulated substances. This procedure is called Prior Informed Consent (PIC). When a party has adopted a final regulatory action to ban or severely restrict a chemical, the party notifies the Rotterdam Convention Secretariat; notifications are published in PIC circulars.

[4] This information was found in Commission Regulation (EC) No 2076/2002 dated 20 November 2002.

5.0 Proposed Re-evaluation Decision

The PMRA has determined that imazapyr is acceptable for continued registration with the implementation of the proposed risk-reduction measures. These measures are required to further protect human health and the environment. The labels of the Canadian end-use product must be amended to include the label statements listed in Appendix III. A submission to implement label revisions will be required within 90 days of finalization of the re-evaluation decision.

No additional data are being requested at this time.

6.0 Supporting Documentation

PMRA documents, such as Regulatory Directive DIR2001-03, and DACO tables can be found on our website at www.pmra-arla.gc.ca. PMRA documents are also available through the Pest Management Information Service. Phone: 1-800-267-6315 within Canada or 1-613-736-3799 outside Canada (long distance charges apply); fax: 613-736-3798; e-mail: pmra_infoserv@hc-sc.gc.ca.

The federal TSMP is available through Environment Canada's website at www.ec.gc.ca/toxics.

The USEPA RED document for imazapyr is available on the USEPA Pesticide Registration Status page at www.epa.gov/pesticides/reregistration/status.htm.

OECD status is available at:

www.pic.int/home.php

http://europa.eu.int/eur-lex/lex/RECH_menu.do

List of Abbreviations

°C	degrees Celsius
λ	wavelength
µg	microgram(s)
ADI	acceptable daily intake
a.i.	active ingredient
a.e.	acid equivalent
amu	atomic mass unit
ASAE	American Society of Agricultural Engineers
bw	body weight
CAS	Chemical Abstracts Service
cm	centimetre(s)
cPAD	chronic population adjusted dose
DACO	data code
DEEM	Dietary Exposure Evaluation Model
EC_{25}	environmental concentration to 25%
EDWC	estimated drinking water concentration
EEC	expected environmental concentration [also estimated environmental concentration]
EU	European Union
FIRST	FQPA Index Reservoir Screening Tool
FQPA	*Food Quality Protection Act*
g	gram(s)
ha	hectare(s)
IUPAC	International Union of Pure and Applied Chemistry
kg	kilogram(s)
km/h	kilometre(s) per hour
K_{ow}	*n*-octanol–water partition coefficient
L	litre(s)
LC_{50}	lethal concentration to 50%
LOC	level of concern
m	metre(s)
mg	milligram(s)
MOE	margin of exposure
mPa	milliPascal(s)
MRL	maximum residue limit
nm	nanometre(s)
NOAEL	no observed adverse effect level
OECD	Organisation for Economic Co-operation and Development
PCPA	*Pest Control Products Act*
PHED	Pesticide Handlers Exposure Database
PIC	Prior Informed Consent
pKa	-log10 acid dissociation constant
PMRA	Pest Management Regulatory Agency
PRVD	Proposed Re-evaluation Decision

RED	Reregistration Eligibility Decision
REI	restricted-entry interval
RfD	reference dose
RQ	risk quotient
SF	safety factor
t½	half-life
TSMP	Toxic Substances Management Policy
UF	uncertainty factor
USEPA	United States Environmental Protection Agency
UV	ultraviolet
VMD	volume mean diameter

Appendix I Registered Products Containing Imazapyr as of October 2007

Registration Number	Marketing Class	Registrant	Product Name	Formulation Type	Guarantee (%)
23712	Technical	BASF Canada Inc.	Imazapyr Technical Herbicide	Dust or powder	98.8%
23713	Commercial	BASF Canada Inc.	Arsenal Herbicide	Solution	240 g/L

Appendix II Toxicological Endpoints for Imazapyr Health Risk Assessments[a]

Exposure Scenario	Dose (mg/kg/bw)	Study	UF/SF or target MOE[b]
Acute dietary	An acute dietary endpoint was not selected based on the absence of an appropriate endpoint attributable to a single dose.		
Chronic dietary	**NOAEL** = 250 **Chronic RfD** = 2.5	Oral toxicity study in dog	FQPA SF = 1-fold
Short- and intermediate-term dermal	**NOAEL** = 250	Oral toxicity in dog	MOE = 100
Short-, intermediate- and long-term inhalation	**NOAEL** = 250	Oral toxicity in dog	MOE = 100
Cancer	Classified as Group E. No evidence of carcinogenicity; therefore, a cancer risk assessment was not required.		

[a] These endpoints were selected by the USEPA for imazapyr health risk assessments described in the RED.
[b] UF/SF stands for uncertainty and/or safety factors. MOE stands for margin of exposure.

Appendix III Label Amendments for Products Containing Imazapyr

The labels of end-use products in Canada must be amended to include the following statements to further protect workers and the environment.

I) The following statement must be included in the **PRECAUTIONS** section:

Do not enter or allow others to enter treated areas until sprays have dried.

II) The following statements must be included in the **DIRECTIONS FOR USE** section:

Field sprayer application: DO NOT apply during periods of dead calm. Avoid application of this product when winds are gusty. DO NOT apply with spray droplets smaller than the American Society of Agricultural Engineers (ASAE) medium classification. Boom height 60 cm or less above the weed canopy or ground.

For application to rights-of-way, buffer zones for protection of sensitive terrestrial habitats are not required; however, the best available application strategies which minimize off-site drift, including meteorological conditions (e.g. wind direction, low wind speed) and spray equipment (e.g. coarse droplet sizes, minimizing height above canopy), should be used. Applicators must, however, observe the specified buffer zones for protection of sensitive aquatic habitats.

DO NOT apply by air.

Buffer zones:

Use of the following spay methods or equipment DO NOT require a buffer zone: hand-held or backpack sprayer and spot treatment.

The buffer zones specified in the table below are required between the point of direct application and the closest downwind edge of sensitive terrestrial habitats (such as grasslands, forested areas, shelter belts, woodlots, hedgerows, rangelands, riparian areas and shrublands), and sensitive freshwater habitats (such as lakes, rivers, sloughs, ponds, prairie potholes, creeks, marshes, streams, reservoirs and wetlands) and estuarine/marine habitats.

Method of application	Use	Buffer Zones (metres) Required for the Protection of:	
		Aquatic habitat	Terrestrial habitat
Field sprayer*	Non-crop, non-graze areas and forestry site preparation	1	20**

* For field sprayer application, buffer zones can be reduced with the use of drift-reducing spray shields. When using a spray boom fitted with a full shield (shroud, curtain) that extends to the crop canopy or ground, the labelled buffer zone can be reduced by 70%. When using a spray boom where individual nozzles are fitted with cone-shaped shields that are no more than 30 cm above the crop canopy or ground, the labelled buffer zone can be reduced by 30%.

** Buffer zones for protection of terrestrial habitats are not required for use on rights-of-way, including railroad ballast, rail and hydro rights-of-way, utility easements and roads.

III) The following statements must be included in the **ENVIRONMENTAL HAZARDS** section:

TOXIC to non-target aquatic and terrestrial plants. Observe buffer zones specified under DIRECTIONS FOR USE.

The label amendments presented above do not include all label requirements for individual end-use products, such as first aid statements, disposal statements, precautionary statements and supplementary protective equipment. Additional information on labels of currently registered products should not be removed unless it contradicts the above label statements.

A submission to request label revisions will be required within 90 days of finalization of the re-evaluation decision.

Appendix IV Inputs to Buffer Zone Models

Ground Use Data (from Canadian labels)				
Crop	**Formulation Type**	**Method of Application**	**Number of Application**	**Maximum Application Rate (g a.i./ha)**
Non-crop, non-graze areas	Solution	Field (Medium)	1	0.72 kg a.i./ha

Model Input Data for Aquatic Buffer Zones (from 2006 RED)		
Half-life for aquatic buffer zones	N/A	Assumed stable
Most sensitive freshwater species	Lemna gibba	½ LC_{50} = 0.009 mg a.i./L
Most sensitive estuarine/marine species	Lemna gibba	½ LC_{50} = 0.009 mg a.i./L

Model Input Data for Terrestrial Buffer Zones (from 2006 RED)		
Half-life for terrestrial buffer zones	Soil degradation	Assumed stable
Most sensitive terrestrial plant species EC_{25} for vegetative vigour	Cucumber	EC_{25} = 1.01 g a.i./ha

Buffer zones were calculated by the Buffer Zone Working Group, Environmental Assessment Division.

References

List of Studies/Information Submitted by Registrant

PMRA 1335512	Technical Chemistry file ARS-CYC-1. Samples, Specifications and Analytical Methodology, Material Methods for the Technical Active Ingredient, Process Description, Discussion of Formation of Impurities, Specifications, Chemical Composition of Bound Brook P
PMRA 1335498	Technical Chemistry file ARS-CYC-1. Process Description, Certified Limits for Technical CL 247,997, Discussion of Formation of Impurities, Survey of Technical Samples for Possible Nonvolatile Nitrsamines and Method of Analysis, DACO: 2.99
PMRA 1336020	1992, Technical Chemistry file ARS-BAQ-5. Imazapyr Arsenal Technical Active Ingredient Product Chemistry Data for Agriculture Canada, DACO: 2.99